

IN THE CLAIMS:

1 1. (CURRENTLY AMENDED) A system for scanning a target of interest comprising:
2 a high-resolution collecting optic;
3 a spatial modulation reticle located in a high-resolution image plane of the collect-
4 ing optic, the reticle being movable a temporally varying pattern in the image plane;
5 a demagnifying relay optic;
6 a primary small-format focal plane array (FPA) detector located in the demagni-
7 fied image plane that receives reticle-modified images and outputs image frames; and
8 a processor that performs, with the image frames, balanced demodulation function
9 that reduces image clutter where the target of interest is in motion.

1 2. (ORIGINAL) The system as set forth in claim 1 wherein the balanced demodulation
2 function comprises:

3

$$VV = \sqrt{\left(V_2 - \frac{V_1 + V_3}{2}\right)^2 + \left(V_3 - \frac{V_2 + V_4}{2}\right)^2 + \left(V_6 - \frac{V_5 + V_7}{2}\right)^2 + \left(V_7 - \frac{V_6 + V_8}{2}\right)^2}$$

4 in which
5 V_r is an output image frame from the FPA on frame number r , and
6 VV is a demodulated output frame derived from a sequence of 8 image frames.

1 3. (ORIGINAL) The system as set forth in claim 2 wherein the demodulation function is
2 defined by a predetermined frame delay and wherein a choice of the predetermined frame
3 delay is made according to a known or expected scene motion environment and a known
4 angular subtense of each of a plurality of cells of the reticle so as to maximize a degree of
5 clutter reduction.

1 4. (CURRENTLY AMENDED) The system as set forth in claim 1 wherein the processor
2 is adapted configured to perform enhanced detection of the target-of-interest in motion,

3 wherein a derived motion of the target-of-interest based upon a detection scenario is used
4 to adjust a motion of the reticle so as to generate a desired result.

1 5. (ORIGINAL) The system as set forth in claim 4 wherein the motion is derived by
2 monitoring pitch and roll rates of a movable support that carries each of the high-
3 resolution collecting optic, the spatial modulation reticle, the demagnifying relay optic
4 and the FPA detector.

1 6. (ORIGINAL) The system as set forth in claim 1 wherein the reticle includes a plurality
2 alternating transmissive and non-transmissive cells and wherein a size of each of the cells
3 is defined by a desired instantaneous field-of-view (IFOV) and matches an achievable
4 point spread function (PSF) of the high-resolution collection optic.

1 7. (ORIGINAL) The system as set forth in claim 6 wherein the a cell-to-cell variation in
2 area for each of the cells with respect to all other of the cells is less than 1% and wherein
3 each of the non-transmissive cells are 100% opaque in a spectral band of interest and
4 wherein a transmissivity of each of the transmissive cells varies by no greater than 1 %
5 with respect to the transmissivity of all other of the transmissive cells.

1 8-11 (CANCELLED)

1 12. (ORIGINAL) An apparatus for spatial modulation imaging (SMI) including a high-
2 resolution collecting optic, a spatial modulation reticle located in a high-resolution image
3 plane of the collecting optic, the reticle moving in the image plane, a demagnifying relay
4 optic and a primary small-format focal plane array (FPA) detector located in the demag-
5 nified image plane, the apparatus further comprising:

6 a foveal enhanced imaging (FEI) mechanism having an amplitude beamsplitter
7 located either (a) just before or (b) after the reticle moving plane, to split off a fraction of
8 a high-resolution image intensity; and

9 a spectral band width or polarization component, for retaining the high-
10 resolution image by routing it to one of either a secondary focal plane array detector or a
11 shared portion of the primary FPA.

1 13. (ORIGINAL) The apparatus as set forth in claim 12 further comprising an additional
2 small-format FPA employed to output the high-resolution image of a selected subarea
3 from the scene, an extent of the subarea being determined by a size of the additional FPA.

1 14. (ORIGINAL) The apparatus as set forth in claim 13 further comprising a secondary
2 optical path that leads from the beamsplitter through a 1:1 magnification optic to the ad-
3 ditional FPA.

1 15. (CURRENTLY AMENDED) The apparatus as set forth in claim 14 wherein the addi-
2 tional FPA is located directly on the reticle surface to intercept the high-resolution image
3 and is adapted-configured to be slewed to the desired point in a scene of the high-
4 resolution image.

1 16. (ORIGINAL) An apparatus for spatial modulation imaging (SMI) including a high-
2 resolution collecting optic, a spatial modulation reticle located in a high-resolution image
3 plane of the collecting optic, the reticle moving in the image plane, a demagnifying relay
4 optic and a primary small-format focal plane array (FPA) detector located in the demag-
5 nified image plane, the apparatus further comprising:

6 a foveal enhanced imaging (FEI) mechanism having an amplitude beamsplitter
7 located either (a) just before or (b) after the reticle moving plane, to split off a fraction of
8 a high-resolution image intensity; and

9 a spectral bandwidth or polarization component, for retaining the high-
10 resolution image by routing it to a shared portion of the primary FPA.

- 1 17. (ORIGINAL) The apparatus as set forth in claim 16 further comprising a secondary
2 optical path that leads from the beamsplitter through a 1:1 magnification optic to the
3 shared portion of the primary FPA.
- 1 18. (ORIGINAL) A system for foveal enhanced imaging of a scanned scene in a sensor
2 having a large throughput collection optic and a high-resolution scene image at a reticle
3 plane and a lower-throughput relay optic and low-resolution scene image that follows at a
4 detector, the system comprising:
5 a mechanism that employs spillover light that is otherwise lost in a transition
6 from the large throughput collection optic and high resolution scene image at the reticle
7 plane to the lower throughput relay optic and low resolution scene image that follows at
8 the detector plane.
- 1 19. (CURRENTLY AMENDED) The system as set forth in claim 18 wherein the mecha-
2 nism includes one of either a large-diameter folding mirror with a hole in center for cap-
3 turing the spillover light, or a dichroic beamsplitter with an appropriately transmitting
4 center area, so as to pass the light passing through an acceptance aperture of the relay optic
5 while reflecting to the side all the light that falls outside the acceptance aperture of the
6 relay optic, and a slewable relay mirror that refocuses the otherwise-lost light onto a sec-
7 ond FPA to display a foveal enhanced image of a selected subarea of the scene.
- 1 20. (NEW) The system as set forth in claim 1 wherein the processor is configured to
2 identify a region of interest and direct a high resolution sensor to magnify and further ex-
3 amine the region of interest.
- 1 21. (NEW) The system as set forth in claim 1 wherein the demagnifying relay optic di-
2 rectly light from the spatial modulation reticle to the FPA detector and provides:
3 a lateral demagnification equal to a ratio of a spatial modulation factor (SMF)
4 times a reticle cell width to the pixel pitch of the FPA detector, wherein the SMF is a
5 measure of a number of cells imaged onto each element (pixel) of the FPA detector; and

6 blurring of a reticle pattern onto the FPA detector such that no more than 50% of
7 a point spread function's (PSF's) energy falls within a central 25% of an element (pixel)
8 area of the FPA detector, while at least 50% of the PSF's energy falls within the element
9 (pixel) area of the FPA detector.

1 22. (NEW) The system as set forth in claim 1 wherein the spatial modulation reticle has
2 a fixed cell pattern of opaque and transparent cells, created by deposition, etching and
3 photolithography processes, and the system further comprises:

4 a long stroke drive mechanism to translate the reticle across a full extent of the
5 image of the scene at constant velocity.

1 23. (NEW) The system as set forth in claim 1 wherein the spatial modulation reticle has
2 a fixed cell pattern of opaque and transparent cells, created by deposition, etching and
3 photolithography processes, and the system further comprises:

4 a short stroke oscillatory drive mechanism to translate the reticle at least four
5 cell widths at constant velocity plus turn-around-and-velocity-stabilization time at each
6 end of the stroke.

1 24. (NEW) The system as set forth in claim 1 wherein the spatial modulation reticle has
2 a fixed cell pattern of opaque and transparent cells, and the system further comprises:

3 an active digital device that provides independent control of each of the cells,
4 the digital device including at least one of micromirror arrays, addressable membrane
5 mirrors and pneumatic liquid crystals.

1 25. (NEW) The system as set forth in claim 1 wherein lateral demagnification in the de-
2 magnifying relay optic is equal to a ratio of a spatial modulation factor (SMF) times reti-
3 cle cell width to a detector pixel pitch.